## Title

The California Simulation of Insurance Markets (CalSIM), Version 2, Methodology and Data Sources



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CalSIM

California Simulation of Insurance Markets

*The California Simulation of Insurance Markets (CalSIM) model is designed to estimate the impacts of various federal and state policies on employer decisions to offer insurance coverage and individual decisions to obtain coverage in California. It was developed by the UC Berkeley Center for Labor Research and Education and the UCLA Center for Health Policy Research.*

# The California Simulation of Insurance Markets, Version 2

## Methodology and Data Sources

July 2019

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# I. INTRODUCTION

When enacted in 2010 the Patient Protection and Affordable Care Act (ACA) was universally recognized as the most important US health policy legislation since Medicare and Medicaid were enacted in 1965. The ACA made changes that affected nearly all participants in the US health care system, including the US general population, large and small employers, public and private insurers, physicians, hospitals, pharmaceutical firms and medical device manufacturers. Key features of the law included:

- An employer mandate to offer affordable health insurance and monetary penalties for firms that did not;
- An individual mandate which required that nearly all US residents take-up health insurance or face monetary penalties;
- The creation of health benefit exchanges to sell individual market insurance and provide health insurance subsidies for individuals who did not have an affordable offer of employer-sponsored health insurance (ESI) and were not eligible for Medicaid, Medicare and other public health insurance programs;
- Consumer protections including a requirement that individual market premiums could only vary based on a few dimensions (e.g., age) and that plans must offer a benefit package that covered a minimum set of essential health care services;
- An expansion of the Medicaid eligibility threshold to 133% (138% including the 5% disregard), and an expansion of Medicaid eligibility to low-income childless adults.

In some instances, existing work from the health economics and health policy literatures could be used to predict firm and individual behavior in response to policies embedded within the ACA. For example, a substantial amount of research exists on how increasing Medicaid eligibility affects Medicaid take-up.[1,2,3,4,5] A substantial academic literature also exists on how Medicaid

[1] Dillender, M. (2017). Medicaid, family spending, and the financial implications of crowd-out. *Journal of Health Economics, 53*, 1-16. doi:https://doi.org/10.1016/j.jhealeco.2017.02.002.
[2] Holahan, J., Buettgens, M., Carroll, C., & Dorn, S. (2012). The Cost and Coverage Implications of the ACA Medicaid Expansion: National and State-by-State Analysis. Urban Institute. Washington DC: Kaiser Family Foundation.

eligibility affects ESI coverage.[6,7,8] Evidence from this pool of studies was informative regarding potential crowd-out effects in the ESI market.

Yet, prior academic and policy work was less informative regarding the potential effects of other important ACA policies. The wide scale changes to the individual health insurance market with respect to limits on premiums and coverage of essential benefits had no clear prior historical precedent in the US.[9,10] With respect to employer mandates only two US states (Hawaii and Massachusetts)[11,12,13] had implemented similar laws prior to the ACA. Knowledge regarding the

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[3] Dorn, S., Holahan, J., Carroll, C., & McGrath, M. (2013). Medicaid Expansion Under the ACA: How States Analyze the Fiscal and Economic Trade-Offs. The Urban Institute. Washington DC: Robert Wood Johnson Foundation.

[4] Gresenz, C. R., Edgington, S. E., Laugesen, M., & Escarce, J. J. (2012). Take-up of public insurance and crowd-out of private insurance under recent CHIP expansions to higher income children. *Health services research, 47*(5), 1999-2011. doi:10.1111/j.1475-6773.2012.01408.x.

[5] Prior to the ACA, Medicaid eligibility was primarily restricted to select populations, such as children, pregnant women and the disabled. Directly applying Medicaid take-up rates calculated from these populations to newly covered populations under the ACA such as single adults is potentially problematic.

[6] Cutler, D. M., & Gruber, J. (1996). Does Public Insurance Crowd out Private Insurance?*. *The Quarterly Journal of Economics, 111*(2), 391-430. doi:10.2307/2946683.

[7] Gruber, J., & Simon, K. (2008). Crowd-out 10 years later: Have recent public insurance expansions crowded out private health insurance? *Journal of Health Economics, 27*(2), 201-217. doi:https://doi.org/10.1016/j.jhealeco.2007.11.004.

[8] Cutler, D. M. G. J. (1997). Medicaid And Private Insurance: Evidence And Implications. *Health Affairs, 16*(1), 194-200. doi:10.1377/hlthaff.16.1.194.

[9] Parente, S. T., Feldman, R., Abraham, J., & Xu, Y. (2011). Consumer Response to a National Marketplace for Individual Health Insurance. *The Journal of Risk and Insurance, 78*(2), 389-411.

[10] Gruber, J. (1994). State-mandated benefits and employer-provided health insurance. Journal of Public Economics, 55(3), 433-464. doi:https://doi.org/10.1016/0047-2727(93)01407-2.

[11] Buchmueller, TC., DiNardo, J., & Valletta, RG. (2011). The Effect of an Employer Health Insurance Mandate on Health Insurance Coverage and the Demand for Labor: Evidence from Hawaii. *American Economic Journal*: *Economic Policy*, 3(4), pp.25-51.

[12] Gruber J. (2013). Evaluating the Massachusetts health care reform. *Health services research*, *48*(6 Pt 1), 1819-24.

[13] In 1974, Hawaii required that all private-sector employers provide health insurance to individuals working more than 20 hours per week. One significant difference between the Hawaii mandate and the ACA mandate is that the ACA only requires that employers provide coverage to individuals working 30 hrs. Per week or more. The Massachusetts employer mandate, which was a part of the Massachusetts health reform in 2006 also differed from the ACA employer mandate in significant ways. Notably, the Massachusetts employer penalty

potential effects of the individual mandates was similarly sparse as only Massachusetts had previously implemented a penalty for individuals not taking up health insurance coverage. In conjunction with limited historical experience with many of the policies embedded within the ACA, the fact that all of these policies would be implemented simultaneously made predictions based on historical experience problematic. For example, an individual under the ACA might not only be newly eligible for Medicaid but would also have access to purchasing health insurance on the health insurance exchanges. In this instance, predictions would have to consider how an individual values the benefits and costs of taking up Medicaid vs. purchasing health insurance on the individual health insurance market. The simultaneous implementation of all of these policies made it challenging to predict the effect of the ACA on the overall health insurance rate and the distribution of individuals across different health insurance types.

Today policy makers at the federal and state levels continue to consider and implement modifications to the ACA. In 2017, Congress attempted to pass legislation that would have repealed much of the ACA. Congress voted on legislation that included significant cuts to Medicaid funding and a repeal of the individual mandate. While none of the ACA repeal-related legislation passed Congress, in 2017 the individual mandate penalty for not having health insurance was zeroed out effective in 2019.[14] Finally, while the gains from the ACA and state policies have been substantial and the US uninsured rate at a historic low, states such as California continue to evaluate policies that are aimed at further lowering the state uninsured rate and making health insurance more affordable for individuals and families that currently have health insurance.

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amounts and definition for affordable coverage differed from the ACA penalty amounts and ACA definition of affordable coverage.

[14] After the change in federal rules New Jersey, DC, Vermont and California passed legislation requiring a state level individual mandate. Several other states including Connecticut, Hawaii, Maryland, Minnesota, Rhode Island, and Washington are also considering implementing state level individual mandates (https://www.healthcare.com/blog/states-with-individual-mandate/).

# II. CalSIM version 2 Model Architecture Overview

CalSIM version 2 is a utility-based micro-simulation model of state and national policy effects on the health care coverage of California's population. CalSIM version 2 differs from the first version of CalSIM which was primarily elasticity-based and relied strongly on parameter estimates from the literature to identify policy effects on individual health insurance take-up decisions.

Microsimulation is a powerful technique for investigating the impact of a policy or set of policies on outcomes of interests to researchers and policymakers (Desai, 2012; Orcutt, 1976).[15,16] Simulations typically use micro-data combined with an underlying knowledge of the behavior of agents (individuals, households, firms) to evaluate the range of potential outcomes that are due to policy. Micro-simulation is particularly useful for understanding the potential effects of policies when multiple policies that are likely to affect the same set of agents are implemented simultaneously. The main objective of the CalSIM model is to understand and quantify the decisions of California individuals, households, and employers in response to ACA and California health policy. CalSIM draws on the health economics, labor economics, statistics, and decision theory literatures to forecast health insurance coverage and contribute to the progress and implementation of health policy reform in California.

Conceptually, CalSIM is designed to model both firm decision-making with respect to the offer of health insurance to employees as well as individual and household decision-making with respect to the take-up of health insurance. Employer decisions reflect worker preferences and employer offering decisions impact health insurance premiums. Health insurance premiums affect individual take up decisions, and public and private insurance markets interact with respect to adverse selection, crowd out of private health insurance, employer penalties, and individual mandates. Firm decision-making with respect to offering health insurance coverage

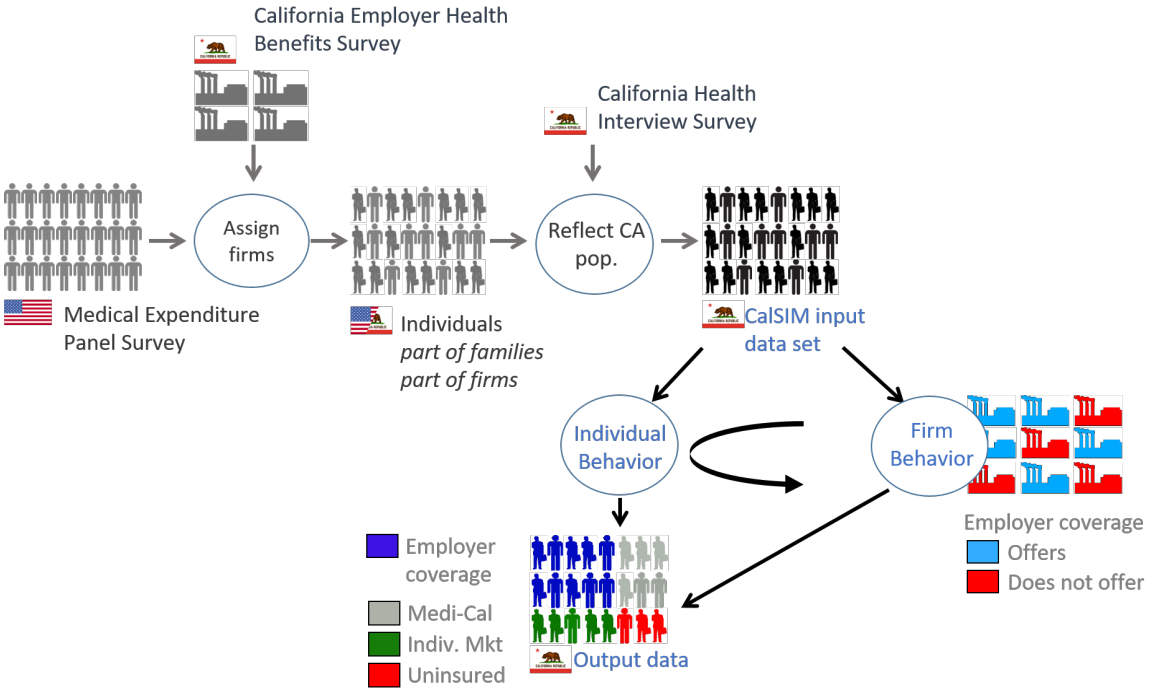
[15] Simulation for Policy Inquiry. (2012). (D. Anand Ed.). New York: Springer.
[16] Orcutt, G., Caldwell, S., & Wertheimer, R. (1976). Policy Exploration Through Microanalytic Simulation. Washington, DC: Urban Institute.

accounts for potential excise taxes levied on firms, penalties that firms potentially face for not offering affordable coverage to their employees, and the outside health insurance coverage options (Covered California and potentially Medicaid) available to employees within firms. Individual decision-making accounts for both increased options for individuals with respect to health insurance coverage (Covered California and potentially Medicaid) and individual specific policies such as potential penalties due to the individual mandate. In the utility maximization framework, individuals compare their utility from being in the health insurance states that are within their choice set and pick the health insurance state that provides them with the largest utility.

Figure I depicts how input data are combined to create the CalSIM input data set (reading from left to right in grey), and then the modelling flow within CalSIM to produce output data (from top to bottom). The CalSIM individual data set is constructed by reweighting the household component of the 2007-2013 Medical Expenditure Panel Survey (MEPS) Western region respondents to represent California's population. MEPS data are reweighted primarily using the 2011-2012 California Health Interview Survey (CHIS) joint distributions of socio-economic and demographic characteristics, including predicted immigration status. Reweighting of MEPS data occurs at the regional and state levels, which allows CalSIM to simulate outcomes at both the regional[17] and state levels. MEPS individuals identified as workers are also statistically matched with employer characteristics including firm size, firm offer behavior (to part-time and full-time workers), and percent take-up by employees within a firm from the California Employer Health Benefits Survey (CEHBS) data. MEPS employed individuals are also assigned to synthetic firms created from the CEHBS data based on matching employer and employee characteristics. CEHBS data also provides information on whether or not the firm offers health insurance benefits and the costs (actuarial value) of the offered health insurance benefits.

[17] CalSIM region categorizations match Covered California rating region groupings, combining rating regions 9 and 12 (Central Coast) as well regions 10 and 11 (Central Valley).

*Figure I. CalSIM flow diagram for input data set creation and decision modeling*




After individual and firm dataset creation, firms first make decisions on whether or not employees are offered employer sponsored health insurance. If a firm decides not to offer ESI, then these individuals make their health insurance decision from a choice set that includes individual market coverage, Medicaid if eligible, or having no health insurance. Individuals for whom there is an ESI offer have a larger health insurance choice set. Additionally, the model calculates eligibility for subsidies on Covered California based on FPL, immigration status (i.e. undocumented immigrants cannot purchase through Covered California), and affordable firm offer. This health insurance choice set is fully defined for all individuals in CalSIM and individuals are allowed to choose the health insurance state that gives them the highest utility.

CalSIM is focused on understanding the effects of national and state policies on the California population. The focus on California has two key implications for modeling. First, to the fullest extent possible, we use individual, household, and firm level data that are representative of the California population. This includes using data from CHIS, data from the MEPS Western region, and data on California employers from CEHBS. Second, California is relatively unique with respect to the share of the state population that is undocumented. CalSIM also accounts for this

feature of the California population by using information collected from CHIS and the Pew Foundation on the number of undocumented individuals in California.

# III. The Affordable Care Act and California Health Insurance Policies

## Employer-Sponsored Insurance Related Provisions

### *Employer Responsibilities for Providing Health Coverage and Penalties*

Firms employing 100 or more full-time equivalent non-seasonal employees were subject to the employer responsibility requirements in the ACA starting in 2015, and firms with 50 or more employees starting in 2016. In 2018, if the employer does not offer coverage to 95% of their full-time employees and has at least one full-time employee receiving subsidies in the exchange, the firm is subject to a penalty of $2,320 per full-time employee. An employee is defined as working full-time if they work 30 or more hours per week and the penalty is not applied to the first 30 employees in the firm. In subsequent years, the penalty increases at the same rate as the average U.S. per capita health insurance premium. Firms that offer coverage are also subject to penalties if the plan does not offer affordable coverage[18] (single only policy is offered at greater than 9.86% of income) or if the employer's plan has an average actuarial value of less than 60% (i.e., minimum value coverage) and a full-time employee receives a tax-credit subsidy on the exchanges. The penalty is the lesser of $3,480 per full-time employee receiving subsidy or $2320 per full-time employee, excluding the first 30 employees. Employer-based insurance premiums continue to be excluded from taxable income for the employee and excluded from the payroll tax of the employer after passage of the ACA. This is also the case in the small group market. Finally, until 2016, firms with 50 employees or fewer could purchase coverage in the Covered

[18] IRS. (2019, February 26). *https://www.irs.gov/pub/irs-drop/rp-18-34.pdf*. Retrieved from www.irs.gov.

California for Small Business market.[19] Starting in 2016 and after, California employers of 100 or fewer workers can purchase coverage in this market.

### *Young Adult Dependent Care Expansion*

One of the first provisions of the Affordable Care Act to take effect was an expansion of insurance coverage for young adults up to (but not including) 26 years of age whose parents have employer-sponsored or individual health insurance[20]. This provision applies to all new plan years starting on or after September 23, 2010—as of that date, adult children, regardless of residence, student status, or marital status, are eligible for insurance under their parents' health plan (U.S. Department of Labor, 2013). This eligibility under their parents' health plan was extended to young adults regardless of whether they were eligible for insurance through another employer or through a state health exchange. Prior to the dependent care coverage expansion, young adults had the highest rates of uninsurance of any age group (Collins, Robertson, Garber, & Doty, 2013) and low rates of access to employment-based insurance (U.S. Department of Labor, 2013).[21]

## Individual Coverage Related Provisions

### *Individual Mandate*

Starting January 1, 2014, every U.S. Citizen and legal resident was required to have qualified health insurance coverage through enrollment in Medicaid, Medicare, Children's Health Insurance Plan (CHIP), employer-based, or individually-purchased insurance plans. In 2018,

[19] Previously called Small Business Health Options Program (SHOP).

[20] With the additional requirement that the parental health insurance plan offered dependent care coverage in the first place.

[21] Monheit, Cantor, DeLia, and Belloff (2011) found that prior to enactment of the Affordable Care Act 22 states had already mandated that insurance companies offer coverage to some dependents, but these state mandates did not materially change net insurance rates in the under-26 population. Part of the reason for the lack of an effect was that, unlike the Affordable Care Act dependent care coverage expansion, these state mandates exempted firms with self-funded insurance (covering 59% of workers in 2010 (Kaiser Family Foundation and Health Research & Educational Trust, 2010) from these regulations under a provision of the 1974 Employee Retirement Income Security Act (ERISA; Monheit et al., 2011).

those who did not obtain health insurance coverage were penalized the greater of $695 per adult and half of that amount per child (up to a maximum of $2,085 per family) or 2.5% of household income.[22] However, the Tax Cuts and Jobs Act of 2018 zeroed out the individual mandate penalty for tax years starting in January 1, 2019. The reporting requirement still exists, but no penalty is charged regardless of insurance coverage status. In June of 2019, the CA legislature took action and instituted a state individual mandate that goes into effect on January 1, 2020. Starting January 2020 California residents will be subject to a state individual mandate that is roughly equivalent to the previous federal penalty.

There are several exemptions to the individual mandate penalty and CalSIM models three key exemptions: 1) Individuals and families with low-incomes are not required to file a tax return and are exempted from the penalty. In 2018 the threshold for filing for a single individual was $12,000 and the threshold for filing for married couples was $24,000. 2) Individuals are also exempt if health insurance is defined as unaffordable, which in 2018 required having to spend more than 8.16% of household income on coverage and 3) Undocumented individuals are also exempt from the penalty.

### *Health Benefit Exchange / Covered California*

To facilitate the purchase of insurance for individuals who are not offered insurance by their employers, do not have access to employer-based coverage due to self-employment or unemployment, or have employer-offered coverage that is unaffordable, the ACA encourages the creation of regional or state-based Health Benefit Exchanges. In states not creating their own exchange, the Department of Health and Human Services operates their insurance marketplace. The ACA allows for state exchanges to operate in parallel with the non-exchange small group and individual health insurance markets. However, the ACA requires the same rules to be followed in the non-exchange market and the exchange market.

The ACA allows any legal resident or citizen of the U.S. living in California to purchase health insurance through Covered California. Covered California subsidies are only available to those

[22] Kaiser Family Foundation. (2019, February 26). *https://www.kff.org/infographic/the-requirement-to-buy-coverage-under-the-affordable-care-act/*. Retrieved from www.kff.org.

who are income-eligible, are not eligible for other minimum essential coverage, including Medicare, Medi-Cal and Healthy Families, and are not offered affordable ESI. Undocumented residents are neither eligible for subsidies nor may they purchase coverage through Covered California, though they may purchase coverage on the off-exchange individual market. Under final regulations, employees and their family members are ineligible for subsidies if employee contributions to job-based self-only coverage are less than 9.86% of income (in 2019), regardless of the cost of family coverage.

California's authorizing legislation (AB 1602/SB 900) introduced a higher standard for the small group and individual insurance markets that operate in the state by going further than federal law in several respects. Specifically, Covered California:

1. Required insurers participating in the Exchange to sell products in each of the four main actuarial value categories (Bronze, Silver, Gold, Platinum), both on- and off-Exchange.

2. Simplified the decision-making process for consumers by requiring plans both on and off the Exchange to have standardized benefit designs *within* metal tier, (i.e. the same deductibles and copayments).[23,24]

Prior to 2014, there was no guaranteed issue in the individual insurance market for adults, though guaranteed issue was available for children contingent on specific open enrollment periods due to the ACA starting in 2011. Additionally, premium pricing was based on modified community rating (age, rating region, and family size) starting in 2014.[25] These tax credit

[23] Other states with standardized benefit designs on the exchanges include Connecticut, Massachusetts, New York, Oregon, Vermont and the District of Columbia.

[24] In 2018, the Federal government allowed for the reintroduction of short-term health plans into the health insurance market. Due to adverse selection concerns, California banned the sale of short-term plans within the state. (https://www.healthaffairs.org/do/10.1377/hblog20180801.169759/full/).

[25] The ACA encouraged high-risk purchasing pools to be created to allow consumers who have been without insurance for at least six months and who have been denied coverage by a commercial insurance plan, to buy a policy partially subsidized by the federal government through state-designed high-risk pools. In California, the Pre-Existing Condition Insurance Program (PCIP) filled this need and enrolled over 11,000 individuals as of November 2013. These

subsidies are based on the pricing of the second-lowest Silver plan (i.e. the benchmark) in the rating region. Premium subsidies can be applied to any plan in the Exchange with consumers being responsible for paying the difference between the benchmark and the premium of their plan, but individuals must enroll in a Silver plan to be eligible for cost sharing subsidies.

The premium subsidies are available as advance payment tax credits (APTCs) at the time of purchase and subsidy levels are dictated by household income based on Modified Adjusted Gross Income (MAGI). Individuals and families who take up health insurance are expected to contribute a fixed percentage of income (based on FPL) towards health insurance premiums. The tax credit is then calculated as the difference between the premium for the second lowest cost Silver plan in that family's rating region and the family's required contribution based on income. In essence, the percentage thresholds act as a cap on an individual or family's spending on health insurance premiums.

*Table 1. 2019 Premium Caps After Income Based Premium Subsidies in the Exchange*[26]

| Household Income (MAGI as a Percentage of Federal Poverty Level) | Premium costs as a % of Income |
|---|---|
| Less than 133% | 2.08% |
| 133%-150% | 3.11%-4.15% |
| 150%-200% | 4.15%-6.54% |
| 200%-250% | 6.54%-8.36% |
| 250%-300% | 8.36%-9.86% |
| 300%-400% | 9.86% |
| Over 400% | No Cap |

enrollees were transitioned into ACA-compliant guaranteed issue insurance markets as of January 1, 2014.

[26] IRS. (2019, February 26). *https://www.irs.gov/pub/irs-drop/rp-18-34.pdf*. Retrieved from www.irs.gov.

Note: Those otherwise eligible for full-scope Medi-Cal coverage are not eligible for subsidies. Medi-Cal eligibility extends to 138% FPL due to a 5% "income disregard".

*Table 2. Cost Sharing Subsidies in the Health Insurance Exchange*[27]

| Household Income (MAGI as a Percentage of Federal Poverty Level) | Actuarial Value of Silver Plan after subsidies |
|---|---|
| ≤ 150% | 94% |
| >150% and ≤ 200% | 87% |
| >200% and ≤ 250% | 73% |
| >250% and ≤ 400% | 70% |

Note: Despite the Federal Government stopping the CSR payments, plans now build them into the underlying silver premiums per state guidance on "Silver Loading."

## *Changes to Standards of Private Insurance Plans*

The ACA requires the creation of an Essential Health Benefits (EHBs) package that will serve as a standard for all health insurance plans offered for sale in the individual and small group markets in and out of the Exchange. Grandfathered plans are exempt from this requirement, as are employer-based (large group) plans. However, the EHBs package is supposed to cover benefits comparable to a typical employer-based plan. The benefits identified in the statute include:

1. Ambulatory Patient Services
2. Emergency Services
3. Maternity and Newborn Services
4. Mental Health and Substance Abuse Services (including Behavioral Health Counseling and Treatment)
5. Prescription Drugs
6. Rehabilitative Services and Devices
7. Laboratory Services

[27] Kaiser Family Foundation. (2019, February 26). *https://www.kff.org/health-reform/issue-brief/explaining-health-care-reform-questions-about-heath/*. Retrieved from www.kff.org.

8. Preventive and Wellness Services
9. Chronic Disease Management
10. Pediatric Services (including oral and vision care)

The Department of Health and Human Services gave states flexibility to determine exactly which items and services will be included in each of the 10 categories of EHBs. California selected the Kaiser Small Business 30 HMO plan as the EHBs benchmark and added several benefits (including mental health services) to comply with the ACA.[28] States are scheduled to update their EHBs benchmarks in 2020.

## *Eligibility for Medicaid and Other Public Programs*

Prior to the ACA in California, families with children age 18 and under, and seniors or persons with disabilities or medical needs had to meet various categorically-based income thresholds to qualify for Medi-Cal. The ACA created one eligibility threshold for the non-elderly adult population, at 133% of FPL. In addition, the ACA requires the use of MAGI (Modified Adjusted Gross Income – see Section 4.4 for details on calculating MAGI) and expands eligibility to all individuals meeting the income and residency requirements, including childless adults who were previously not eligible. However, to maintain existing programs and to calculate federal matching contributions, both "old" and "new" Medicaid eligibility criteria are used to evaluate eligibility for the programs in each state.

States are required to maintain current Children's Health Insurance Program (CHIP) eligibility standards through 2019. CHIP eligibility in California extends to children in families with incomes up to 266% FPL. CHIP funding was extended through 2015 and the federal CHIP match rate increased by 23 percentage points between 2015 and 2019.[29] The CHIP reauthorization of 2018

[28]The following document summarizes the benefits included in California's benchmark plan: https://www.cms.gov/CCIIO/Resources/Data-Resources/Downloads/Updated-California-Benchmark-Summary.pdf.

[29] UC Berkeley Labor Center Summary of Affordable Care Act Provisions Affecting Children, Non-Elderly Adults and Employers; Affordable Care Act, Sec. 2101

requires the matching rate to decrease to their previous enhanced level (65% in California) by 2023, with an 11.5% reduction in 2020.[30]

Finally, California allows for certain non-citizens to be covered under Medicaid. Lawful Permanent Resident Adults who have a green card for at least five years are eligible for full-scope Medi-Cal with federal matching, but California decided to include recent Lawful Permanent Resident immigrants in Medi-Cal using state funds since 2014. In other states, these LPR who did not meet the five-year green card requirement are in the Exchange. In California, they are ineligible for exchange tax credits and cost sharing reductions up to 138% FPL due to being eligible for Medi-Cal. Starting in 2016, California expanded eligibility for full-scope Medi-Cal to all low-income children, regardless of immigration status.

## Unmodeled National and California Policies and Policy Features

Although CalSIM models the effects of many important ACA and California policies related to health insurance coverage, there are some ACA and California policies that are not included in CalSIM due to data limitations. First, for the individual market CalSIM does not distinguish between those purchasing coverage via Covered California and those purchasing coverage on the individual market directly from insurers. The model is only able to distinguish whether the individual is eligible for and receives subsidized coverage—to receive these subsidies they must enroll via Covered California. For those who do not qualify for subsidies, we cannot distinguish between those who purchase via Covered California and those that purchase directly. Second, some exemptions from the individual mandate could not be modeled. Individuals and families maybe be exempt from the individual penalty if they experienced financial hardship, had religious objections, were American Indians in federally recognized tribes, lacked insurance coverage for less than three months (applicable only to the first gap in coverage), or had been incarcerated. Third, Medicaid eligibility could not be fully modeled. Eligibility based on pregnancy or disability could not be measured, though those who reported Medicaid coverage prior to the ACA were able to stay in Medicaid coverage even if they did not appear to meet the income eligibility requirements. California allows for DACA individuals to be covered through

[30] https://www.kff.org/medicaid/fact-sheet/summary-of-the-2018-chip-funding-extension/

Medicaid, but an individual's DACA status is not captured in the MEPS or CHIS data. Finally, CalSIM is unable to model grandfathered plans. Health insurance plans that were in effect on or before the date ACA was signed (March 23, 2010) were eligible to be grandfathered. Grandfathered plans are exempt from certain provisions of the law until they lose their grandfathered status as a result of making certain changes to plan design. For example, grandfathered plans were not required to meet provisions effective for other plans in 2014, including: complying with limits to out-of-pocket maximums, pricing plans based on modified community rating, complying with small group deductible limits, and offering EHBs.

# IV. CalSIM Individual and Firm Level Data

## Medical Expenditure Panel Survey (MEPS)

MEPS is a nationally representative sample of U.S. residents reporting on socioeconomic and demographic characteristics, employment, health status, health insurance, healthcare utilization, and health care expenditures. The 2007–2013 Western region MEPS household component surveys serve as the pool of individuals and households that provide the base data for CalSIM. MEPS provides the underlying joint distribution of individual health care expenditures by household income, sex, age, type of health insurance coverage, employment status, and race/ethnicity. We reweight the Western region MEPS data to be representative of the California population using information from the 2011-2012 California Health Interview Survey (CHIS, described later in this section). Households are identified as health insurance eligibility units (HIEUs) in MEPS and data on spouses/dependents are linked to the corresponding primary worker or primary health insurance policyholder using the latest round of the survey. In creating HIEUs, unmarried adult children younger than 26 years old living at home are grouped into their parents' HIEU. HIEUs with one or more institutionalized, deceased, or active duty military individuals were excluded, as were HIEUs whose oldest member was younger than 16.

## *Imputing Documentation Status*

Immigration documentation status is a critical determinant of eligibility for Medicare, Medicaid, and Covered California health insurance coverage. Documentation status in CalSIM includes four mutually exclusive categories: US citizen, legal permanent resident in the U.S. for five or more years, legal permanent resident in the U.S. fewer than five years, and unauthorized immigrant (undocumented). Imposing a five-year threshold for the legal permanent resident population stems from the federal Medicaid eligibility requirement of five years legal residency. California currently allows legal residents with fewer than five years in the U.S. to enroll in Medi-Cal, but it is a completely state-funded population and subject to state budget constraints. We are interested in the probability of persons being unauthorized immigrants (undocumented) as they are ineligible for subsidies and Medi-Cal expansion via the ACA but could benefit from guaranteed issue individual market insurance and employer-sponsored insurance coverage and will continue to participate in the California healthcare system.

The MEPS public use files, which are the source of CalSIM's individual data, do not identify undocumented individuals. To identify this critical status in MEPS, we first estimated a multinomial logistic regression prediction model to confidential 2011-2012 CHIS data with a three-category outcome for all adults not born in the United States: citizen or legal permanent resident for at least 5 years, legal permanent resident for less than 5 years, and undocumented. Independent variables in the multinomial logistic regression prediction model included age, sex, race, education level, poverty level, health insurance status, employment status, and family size. CalSIM uses the parameter estimates from this regression model to compute mutually exclusive predicted probabilities (where $\Sigma pn^*=1$) so that each MEPS non-US born adult falls into each of the three CHIS-defined documentation categories.[31] This approach is also used to estimate the predicted probabilities and assign documentations status to children and teens under the age of 18, except that we include the parental documentation predictions from the above estimated

[31] Pourat, Nadereh & Wallace, Steven & W Hadler, Max & Ponce, Ninez. (2014). Assessing Health Care Services Used By California's Undocumented Immigrant Population In 2010. Health affairs (Project Hope). 33. 840-7. 10.1377/hlthaff.2013.0615.

multinomial logistic regression as additional covariates in the child prediction regression equation.

## *Medical Expenditures*

MEPS data captures yearly total and out-of-pocket (OOP) medical expenditures for all surveyed individuals. Total and OOP medical expenditures are key inputs for individual decision-making in CalSIM. For individual decision-making, it's not only important to know total expected expenditures and total expected OOP for an individual under their initial health insurance plan, but also to model what their total expected expenditures and total OOP expenditures would be under other health insurance states. We describe how we model expenditures more fully in a later section where we describe how individual behavior is modeled within CalSIM. For modelling purposes health care expenditures are assumed to increase at an annual rate of 6% and initial values are standardized to 2012 dollars.

## *Modified Adjusted Gross Income*

The modified adjusted gross income (MAGI) of HIEUs is determined based on the total income reported by HIEU individuals in MEPS. MAGI income is used to determine Medicaid eligibility and also used to determine eligibility for subsidies through Covered California (see Exhibit 1).

CalSIM adjusts reported family income to account for certain aspects of MAGI calculations. Defined in the ACA, MAGI is the adjusted gross income (AGI) increased by foreign-earned income and housing cost, and any amount of interest received or accrued by the taxpayer during the taxable year that is exempt from tax. Based on internal analysis data released by the IRS, the largest percentage of adjustments made in the calculation of AGI were the self-employed tax deductions (12%), followed by student loan interest deduction, and then educator expense deduction, tuition and fee deductions, and self-employed health insurance deduction (all at 3%). While MEPS-HC provides data that allow CalSIM to adjust for self-employed tax deductions, data to adjust for the other items in the AGI are not reported.[32]

[32] Additionally, MEPS-HC does not report foreign-earned income, housing costs, or exempted accrued interest to facilitate a precise calculation of MAGI. We estimate that such adjustments

Given the availability of MEPS data and the importance of self-employed tax deductions, CalSIM accounts for these deductions through the following calculation, which is incorporated into the calculation of income for all respondents who report self-employment. Self-employed tax deductions are 50% of the self-employment tax rate of 15.3%. To account for the MAGI calculations, CalSIM increases total income for those reporting being self-employed by 7.65%, before determining Medi-Cal or Health Insurance Exchange eligibility.

### *Program Eligibility*

CalSIM Medi-Cal estimates include only full-scope Medi-Cal coverage. When benchmarking to CHIS data, undocumented adult respondents reporting Medi-Cal coverage are reclassified as uninsured, since they could have only been eligible for restricted-scope Medi-Cal coverage. As mentioned previously, starting in 2016, CalSIM allows undocumented children to be enrolled in Medi-Cal to reflect the change in state law. Individuals who are dually eligible for and enrolled in Medicaid and Medicare are classified as Medicare in CalSIM.

## California Health Interview Survey (CHIS) Data

CHIS is an annual cross-sectional survey of the California non-institutionalized population. CHIS captures detailed demographic information on California adults, teenagers, and children, their health insurance choice, health status, and health care utilization. The CHIS annual data is large: approximately 20,000 individuals are surveyed annually, which allows for calculations that are representative at both the state and regional levels. We use the CHIS data for two primary purposes: 1) We use the 2011-2012 CHIS data as the basis for reweighting the MEPS western

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affect 0.3% of the population and are unlikely to have a significant impact on income calculations for Medicaid and Exchange eligibility determination. Additionally, there is no readily available information on the amount of interest received or accrued by the taxpayer during the taxable year which is exempt from tax. This affects about 4.5% of the households filing at an average amount of $12,370. Due to this data limitation in accounting for the difference between MAGI and AGI, CalSIM assumes that the effect of these data limitations is negligible across the aggregated population and do not significantly impact income or subsidies for purchasing insurance.

region data and 2) We use more recent years of the CHIS data to calibrate CalSIM model output. We describe both of these processes in a later section.

### California Employer Health Benefit Survey (CEHBS) Data

CEHBS is a survey of California firms conducted by the California HealthCare Foundation and the National Opinion Research Center. The pool of firms eligible for participation in the survey include firms in California with 3 or more employees and the survey is completed by employee benefit managers, which increases the accuracy of information regarding the firm. Within CalSIM we use data from the CEHBS to create synthetic firms that are representative of California firms. The CEHBS is conducted yearly and provides detailed information on the health insurance coverage offered (if any) by firms, worker take-up of health insurance coverage offer, as well as other characteristics of the firm[33] and its workforce such as industry, firm size, and the wage profile of the workers. Health insurance benefits information includes data on firm and employer contributions to health insurance coverage, and data on single and family level premiums. Health insurance coverage and benefit information is important for both CalSIM firm and individual behavior modeling.

# V. CalSIM Data Construction

The MEPS individual data and CEHBS firm data are combined into a California-representative population using a two-step process. In the first step, a simulated annealing algorithm samples HIEUs with replacement from MEPS using California-specific target statistics to select a set of households that approximates the California population. In the second step, employed individuals from these HIEUs are matched to firms based on employee and firm characteristics. We describe the simulated annealing and firm assignment algorithms in greater detail below.

[33] It is important to differentiate our use of the term 'firm' (versus 'establishment') from the employer descriptions common to other simulation models. In this case we refer to 'firm' as the single location of a particular employer, whereas other models have referred to such employers as 'establishments' and 'firms' referring to employers with more than one location.

## Simulated Annealing Algorithm

In the first step of data construction, we use a simulated annealing Markov chain Monte Carlo (MCMC) algorithm for finding a configuration of items (discrete units) distributed (with replacement) among bins that optimizes an error function measuring the distance between the distribution of particular item characteristics within and/or across bins and user-specified target distributions.

### *Target Statistics*

To better match the California non-institutionalized population by Covered California rating region, we use CHIS 2011-2012 to determine California regional population targets by:

- Demographics: age, gender, race/ethnicity, income, English proficiency, immigration status, employment, and full/part-time/unemployed status;
- Worker characteristics: worker class (private, public, self-employed), health insurance offer, and government class; and
- Health and insurance-related characteristics: program eligibility, health insurance, health status, and number of chronic conditions.

### *Firm Assignment*

Assigning individual records from MEPS to firms from CEHBS is an essential component of CalSIM's ability to simulate California's employer-sponsored health insurance market. CEHBS reports the health insurance coverage and benefits offered by California firms, but does not contain individual-level data on employees. Conversely, MEPS includes many individual workers, but publicly available MEPS data do not report detailed information on the firms that employ those individuals. To create "synthetic" firms representative of the California employer pool, CalSIM assigns individual workers from MEPS to firms from CEHBS based on the health insurance offering status for part-time and full-time workers, firm size, and the percentage of employees covered by the firm's ESI plan(s). Survey sample sizes and limited firm workforce information mean that it may not be possible to match every worker to a firm on all of these characteristics. Consequently, CalSIM uses an optimization algorithm that attempts to minimize an objective function that quantifies the error of the worker-firm configuration. The algorithm

begins with a random initial assignment. At each iteration, a proposal state is constructed by selecting two workers at random and swapping their firm assignment. When this process is run for a large number of iterations, the firm assignment state will gradually move toward a reasonable configuration.

## Other Key Inputs into CalSIM

CalSIM models the effects of national and California health policies on health insurance take-up using the most recent administrative and population surveys available. Future projections require assumptions regarding population and wage growth in California. Population and wage growth affect many aspects of the model, but most importantly they affect the number of individuals eligible for Medi-Cal and Covered California subsidies. CalSIM does not model changes in the economy but does model the effect of minimum wage policies.

### *Minimum Wage*

When simulating the effects of policies on individuals in future years, we account for existing and planned state and local minimum wage policies.[34] Statewide, from 2019 and 2022, the minimum wage will be increased by $1.00 per hour for nearly all employed individuals. CalSIM also accounts for the fact that some California localities have minimum wage policies that are different from statewide minimum wage policies. Specifically, we model increases in localities within the counties of San Francisco, Los Angeles, Alameda, Contra Costa, Santa Clara, and San Diego. Sub-minimum wage workers also receive an increase when the minimum wage increases, though they remain below the minimum wage. We also model a "ripple effect" of the minimum wage, increasing the wages of workers who were previously at the new minimum wage and just above.

The effect of modeling these changes to income is an increase in FPL that may lead to changes in Medicaid eligibility and the level of health insurance exchange subsidy offer. If a person appeared to be income-eligible for Medi-Cal and had Medi-Cal coverage but loses eligibility as a result of a minimum wage increase, they are assumed to become uninsured in the absence of

[34] https://www.dir.ca.gov/dlse/faq_minimumwage.htm

the ACA, and may take up subsidized individual market insurance or any other insurance coverage for which they are eligible under the ACA policy scenario.

## *Population Projections*

Predictions of the 0–64 California population are based upon totals provided by the California Department of Finance (DOF). Updated estimates pegged to the 2010 census predict a smaller total population than previous DOF projections. We also deflate the 0–64 population by 1.33% to estimate the non-institutionalized population, which is the population covered by the surveys on which CalSIM relies, namely CHIS and MEPS.

# VI. Microsimulation

## Firm Decision-Making

In CalSIM, firms first make decisions on whether or not to offer health insurance to their employees, in response to national and California health policies. The fundamental driver of the firm offer decision in CalSIM is total employee compensation (TEC). TEC is defined as the sum of employee wages and firm contribution to an employee's health care coverage and is explicitly defined as:

TEC=*f*(Wages, Firm Payroll Taxes, Firm Health Care Contributions, Policy Costs)

Firms calculate TEC with respect to offering and not offering health insurance in the presence of the ACA and California policies (e.g., the employer mandate or the individual penalty), and switch the ex-ante offering decision if switching leads to a significantly lower TEC. A key assumption in these calculations is that firms calculate TEC under different policy regimes keeping the disposable income[35] of workers constant. This assumption is based on theoretical and empirical research from the health and labor economics literatures that firms and employees consider health insurance benefits a key part of an employee's compensation package and adjust wages offered and accepted accordingly.[36,37,38,39,40] We implement this

[35] https://www.dir.ca.gov/dlse/faq_minimumwage.htm
orker contributions to health care premium – OOP expenses – Policy Costs

[36] Wages might decrease in response to the cost of coverage, but other effects are possible including reduced employee wage growth and an increase in the number of hours worked by the employed.

[37] Gruber, J. (1994). The Incidence of Mandated Maternity Benefits. The American Economic Review, 84(3), 622-641.

[38] Gruber, J., & Krueger, A. B. (1991). The Incidence of Mandated Employer-Provided Insurance: Lessons from Workers' Compensation Insurance. Tax Policy and the Economy, 5, 111-143.

[39] Cutler, D. M., & Madrian, B. C. (1998). Labor Market Responses to Rising Health Insurance Costs: Evidence on Hours Worked. The RAND Journal of Economics, 29(3), 509-530. doi:10.2307/2556102

[40] Larrimore, Jeff, and David Splinter (2018). "How much does health insurance cost? Comparison of premiums in administrative and survey data," Finance and Economics Discussion

assumption within CalSIM in the following manner. If a firm that was initially offering health insurance decides that not offering has a significantly lower TEC, then wages of individuals in ESI are increased to account for the fact that the firm no longer offers health insurance coverage. Similarly, if a firm that initially did not offer health insurance decides to now offer health insurance and an individual takes up ESI, then that individual's wages are decreased to account for the change in health insurance coverage. Information on firm health care contribution rates is available from the CEHBS data and is used in the TEC calculations to understand the trade-off between firm-contribution and wages. In CalSIM, using the calculated TEC change under different policy regimes, a firm will change their initial offering decision if the TEC decreases by a firm-specific threshold that is based on characteristics predictive of offering coverage, such as the number of employees, industry, and presence of unionized workers.

### *Firm Health Insurance Offer Options in CalSIM*

We allow firms the following options in making the firm offer decision (Table 3). In response to a specific national or state level policy, firms that are offering health insurance in the initial state have two choices. Firms can either continue to offer the same Actuarial Value health insurance plan, with the same employee contribution or to not offer health insurance coverage.[41] Firms that offer health insurance to part-time workers (those working 20-29 hours) choose whether to continue to offer to part-time workers in addition to deciding whether to continue to offer to full-time workers. Alternatively, in response to a specific national or state level policy, firms that are not offering health insurance in the initial state have four choices: (1) offer a health insurance plan typical of other employers of the same firm size and in the same industry; (2)

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Series 2018-030. Washington: Board of Governors of the Federal Reserve System, https://doi.org/10.17016/FEDS.2018.030.

[41] Other firm responses are theoretically and empirically possibly, for example firms can reduce contributions or offer health insurance plans with reduced benefits. We don't model these scenarios since the empirical evidence on the magnitudes of these types of responses is sparse.

offer a Bronze plan with 9.49%[42] employee contribution; (3) offer a Bronze plan with a typical contribution; or (4) continue to not offer health insurance coverage.

*Table 3: Options for Firm Offer*

| | Ex-post: Offer typical ESI AV and contribution | Ex-post: Offer Bronze, 9.49% contribution | Ex-post: Offer Bronze, typical contribution | Ex-post: Don't Offer |
|---|---|---|---|---|
| Ex-ante Offering | ✓ | NA | NA | ✓ |
| Ex-ante Not Offering | ✓ | ✓ | ✓ | ✓ |

## Individual and Household Health Insurance Decisions

The health insurance states of households and individuals are determined by a utility model, which quantifies the utility of each possible health insurance state. Higher utility states are preferable to lower utility states. A health insurance configuration for an HIEU is a set of health insurance coverage options (including being uninsured) for the individuals in the HIEU. The utility of configuration *j* to HIEU *i*, $u_{ij}$ is defined as:

$$u_{ij} = E[(expenditures_{ij}) - premium_{ij} - E(OOP_{ij}) - penalty_{ij}, - wage\ change_{ij} - r\mathrm{Var}(OOP_{ij})]$$

where $expenditures_{ij}$ are the total medical expenditures of the HIEU, $premium_{ij}$ is the sum of the plan premium contributions for the HIEU members, $OOP_{ij}$ is the total of the out-of-pocket expenditures, $penalty_{ij}$ is the tax penalty due to an individual mandate, $wage\ change_{ij}$ is any earnings change from the ex-ante state associated with coverage *j*, *r* is a constant that multiplies the variance of the HIEU's out-of-pocket expenditures as a measure of risk aversion, and E(·) and Var(·) are the expectation and variance operators. CalSIM's utility function modeling of health

[42] The 9.49% represents an amount just below the level where offering firms could be subject employer penalties. The amount was 9.5% in 2014 and has increased as medical cost growth has outpaced consumer inflation.

insurance choice is based on economic theory regarding the value of health insurance and empirical research on the parameter values for the coefficient of risk-aversion.[43,44]

## *Expenditures*

Computing the utility of an HIEU's health insurance state configuration requires knowing expected total expenditures and expected OOP expenditures as well as the variance of OOP expenditures for the coverage of each individual in that configuration. MEPS records the health insurance coverage (ESI, individual market, Medicaid and uninsured) and corresponding total and OOP medical expenditures data for individuals. We use this information and Random Forest[45] Prediction models to calculate expected total and OOP expenditures for individuals in each of their chosen health insurance states.

In addition to knowing expected total and OOP expenditures for an individual in their existing health insurance state, the CalSIM utility choice model requires knowing expenditures for a given individual in each possible health insurance state. We use MEPS data combined with age and health status expenditures adjusters reported in the literature[46]to model expenditures for a given individual in all possible health insurance states. The age and health status adjusters are consistent with prior work on health care spending patterns: that older individuals should have

[43] Goldman DP, Buchanan JL, Keeler EB. Simulating the impact of medical savings accounts on small business. *Health Serv Res*. 2000;35(1 Pt 1):53–75.

[44] Keeler, Emmett B., Joan L. Buchanan, John E. Rolph, Janet M. Hanley, and David Reboussin, The Demand for Episodes of Medical Treatment in the Health Insurance Experiment. Santa Monica, CA: RAND Corporation, 1988. https://www.rand.org/pubs/reports/R3454.html. Also available in print form.

[45] Random Forest is a decision tree machine learning algorithm that combines estimates from multiple decision trees. Decision trees are trained on randomly sampled subsets of data and the final result of the model is calculated from averaging over all the predictions. Features included in the prediction model are age, race, immigration status, industry, limited English proficiency, marital status, employment status, smoking behavior, number of chronic conditions, health status, disability status, income, age, documentation status, MSA status, physical health component summary, mental health component summary and cancer status.

[46] Gruber, J. (2000, February). Tax Subsidies for Health Insurance: Evaluating the Costs and Benefits. NBER Working Paper 7553. Cambridge, MA, USA: NBER.

higher expenditures, on average, than younger individuals and healthier individuals should on average have lower expenditures than sicker individuals. The ratio of the cost index for health, relative to those in excellent health, is 1.21 for very good health, 1.84 for good health, 3.47 for fair health, and 5.8 for poor health. The ratio of the cost index for age, relative to ages 40-44, spans amounts of 0.45 for children under 19 to 2.41 for adults ages 60-64. Using these ratios, we first adjust each MEPS individual's total and OOP expenditures by multiplying their expenditures by their respective age-based and self-reported health status based cost indices. We then calculate MEPS expenditures for each health insurance state and compute the average difference in expenditures across each state. In our calculations, as expected, we find the largest expenditures for ESI individuals, followed by lower expenditures for individual market and Medicaid individuals. We find the lowest expenditures for uninsured, approximately 40% of the total expenditures of an ESI individual. We apply these computed ratios to each individual in CalSIM to identify total expenditures and total out of pocket expenditures for each individual in each of the different health insurance states.

As a final step, CalSIM calibrates expenditure and OOP amounts to match known benchmarks from administrative and survey data. For the non-group market, an expenditure adjustment algorithm is constructed to adjust the distribution of claims to capture higher value claims not found in the MEPS data.[47] Additionally, a constant adjustment is performed so the resulting premiums match those found in the Covered California marketplace.[48] ESI expenditures are adjusted so that the resulting average ESI single premium for workers in offering firms matches the figure published by the most recent CEHBS. Medicaid expenditures are set to match average Medi-Cal claims, as computed by the authors.

## *Premiums*

Premiums are a key input to the utility function calculations. To calculate utilities we need to identify premiums for all the health insurance plan options available within the choice sets of

[47] CalSIM version 2.0 – 2.4 uses data from Minnesota's individual market. CalSIM version 2.5 uses data from Covered California on expenditures among enrollees.
[48] Milliman Individual Health Insurance Market Profile for 2015, State of California.

CalSIM individuals. This includes premiums within ESI and premiums within the individual market.

*ESI*

We identify ESI premiums directly from the CEHBS data, which contains single and family plan premium information for all the plans offered at each firm. For firms that don't offer health insurance, we impute single and family premiums using information on firm size and industry.

*Pre and Post-ACA Non-Group Premiums*

In CalSIM, individuals currently have the option of choosing a Silver and a Bronze plan. CalSIM structures the post-policy non-group premiums faced by California consumers according to specifications in the ACA. The ACA requires modified community rating in determining non-group premiums, as purchased on the Exchange market, and allows insurers to vary premiums solely on single versus family plans, geographic area, age (with a maximum 3:1 ratio), and tobacco use (with a maximum 1.5:1 ratio; California does not allow premiums to vary on this dimension). Drawing on these regulations, CalSIM simulates premium determination based on age, plan type, and community rating using an iterative method, with considerations for fluctuating eligible populations (communities) due to income modifications and ESI affordability. Specifically, CalSIM imputes a single Exchange Silver plan premium that has a 70% actuarial value. We assume that premiums vary by age within the range across age bands of the proscribed maximum 3:1 ratio. CalSIM iteratively modifies the initial Exchange population and premiums for the enrolled population based on individual take-up responses to firm offer decisions. Consequently, CalSIM calculates the Exchange Silver plan premium in each iteration to account for the community rating effects due to changes in average age. Data on pre-ACA premiums offered in the individual market in CA are not readily available. For this reason, we take premiums from the post-ACA time period and use the 2012 deflated values to evaluate health insurance behavior in the pre-ACA period.

In addition to simulating the Exchange eligible populations and premiums, CalSIM calculates the maximum contribution towards premiums paid by each HIEU for the appropriate single or family plan, as a function of the household MAGI and the ACA premium subsidy sliding scale.

Consequently, we are able to estimate eligibility for cost-sharing subsidies based on the maximum HIEU contribution, the 70% actuarial value of the Exchange Silver plan, the Silver plan premium, and the subsidy sliding scale.

## *Penalty*

The individual mandate is modeled in CalSIM as consisting of two parts. First, the penalty captures a fraction of the dollar amount of the actual penalty that an individual is responsible for if they are uninsured. In 2018, those who did not obtain health insurance coverage and were subject to the penalty were penalized the greater of $695 per adult and half of that amount per child (up to a maximum of $2,085 per family) or 2.5% of household income. Second, we also model a constant penalty amount which represents the psychological impact of an individual mandate penalty. This constant amount applies to all California individuals, regardless of whether they are exempt from the penalty, with the notable exception of the undocumented. This psychological component is assumed to be the larger driver of the enrollment effect of the penalty.[49] CalSIM modelling and results with respect to the mandate are described in greater detail in the November 2018 brief titled "**California's Health Coverage Gains to Erode Without Further State Action"**.

## *Utility Calibration*

CalSIM predicts individual health insurance plan choice based on each individual's expected total and OOP health expenditures under different health insurance states, combined with other relevant policy inputs. In the baseline pre-ACA scenario, we estimate individual utilities under each individual's health insurance choice set and let individuals decide on the health insurance state with the largest utility. We then compare the predicted choice health insurance state for each individual with the individual's observed health insurance state. The predicted choice maybe different from the observed choice for multiple reasons. For example, it's unlikely that

[49] Literature examining the effect of the penalty, particularly the effect of the phase in of a larger penalty over the first few years of the ACA, suggests that the psychological effect may be a more important factor than the actual dollar value of the penalty. See Frean, Gruber, Sommers, "Premium Subsidies, The Mandate, and Medicaid Expansion: Coverage Effects of the Affordable Care Act" NBER Working Paper 22213, April 2016.

the chosen functional form of the utility function represents the behavior of all CA individuals with respect to health insurance choice. Similarly, it's unlikely that all individuals have the same risk aversion parameter. If the predicted choice state is different from the observed state, we calculate latent values so that the differences between the predicted and observed health insurance distributions are minimized. Calibration with observed values is implemented at the individual level in the baseline data because we observe both the predicted health insurance choice and the observed health insurance choice for each individual.

We also calibrate projections from CalSIM using the most recent data available from CHIS combined with administrative sources reporting coverage in the individual market. For these calibrations, in contrast to the pre-ACA data where we are able to calibrate to an individual's observed health insurance choice, we are only able to calibrate to aggregate values in data from later years.

# VII. Policy Simulations and Other Applications

CalSIM has been used to analyze the effects of both national and California health policy on health insurance coverage and health insurance markets in CA. In this section we briefly highlight results from three prior CalSIM publications. In addition to these three publications, CalSIM has been the basis for numerous other reports, memorandum for state agencies, California health insurance data books, presentations to stakeholders, and presentations at academic conferences.

**3.6 Million Californians Would Benefit if California Takes Bold Action to Expand Coverage and Improve Affordability**[50] CalSIM was used to simulate the potential effects of the simultaneous

[50] Miranda Dietz, Laurel Lucia, Srikanth Kadiyala, Petra W. Rasmussen, Ken Jacobs, Dylan H. Roby, Dave Graham-Squire, Jason Zhang, Greg Watson, Xiao Chen and Gerald F. Kominski. (April 2019). *3.6 Million Californians Would Benefit if California Takes Bold Action to Expand Coverage and Improve Affordability.* UC Berkeley Center for Labor Research and Education; UCLA Center for Health Policy Research.

implementation of three health policies on the California under 65 population. The three policies that were evaluated are: 1) An expansion of Medi-Cal to all low-income California adults irrespective of immigration status 2) An Increase in affordability help to individuals already receiving federal subsidies on Covered California; an expansion of subsidy offer to eligible California individuals with greater than 400% FPL and 3) Implementation of a state individual mandate penalty that mirrors the federal ACA penalty which was eliminated starting in 2019. CalSIM estimated that the three policies combined would reduce the number of uninsured by 1.7 million under age 65 individuals in 2023 compared to the status quo. With respect to the policies specifically aimed at affordability, CalSIM estimated that 1.45 million individual market enrollees currently receiving federal subsidies would receive additional help. Another 300,000 individuals with income above 400% FPL would receive subsidies such that they pay no more than 8 to 15% of family income on premiums. CalSIM also estimated that premiums would be 10% lower in 2023 due to a healthier risk pool that is the result of the individual mandate penalty and the affordability help. This premium reduction also benefits 560,000 enrollees on the individual market who were not eligible for either state or federal subsidies.

**California's Health Coverage Gains to Erode Without Further State Action (November, 2018)[51]**

In 2019, the individual penalty for not being covered by health insurance was nullified.[52] CalSIM was used to model the effects of this policy change on the number of uninsured in CA, the prior health insurance plan types of the newly uninsured, and any effects on premiums due to changes in the composition of people in the health insurance markets. Compared to a state of the world where the individual penalty was still in effect, CalSIM predicts that between 150,000

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[51]Miranda Dietz, Laurel Lucia, Dylan H. Roby, Ken Jacobs, Petra W. Rasmussen, Xiao Chen, Dave Graham-Squire, Greg Watson, Ian Eve Perry and Gerald F. Kominski. (November 2018). *California's Health Coverage Gains to Erode Without Further State Action.* UC Berkeley Center for Labor Research and Education; UCLA Center for Health Policy Research.

[52] To our knowledge only one prior observational study has evaluated the effects of the individual mandate on health insurance coverage, and they find no effects of the mandate on health insurance coverage. Yet, estimating the effects of policies such as the mandate is difficult in instances such as the ACA where the national attention received by the law might impact both the treatment and control groups used to evaluate the policy.

and 450,000 more Californians will be uninsured in 2020; that these figures will increase to 490,000 to 790.000 more Californians without health insurance by the year 2023. With respect to prior health insurance status, approximately half of these additional uninsured are predicted to come from Medi-Cal and half from the individual health insurance markets. CalSIM also predicts less healthy individuals being in the individual market and an 8-10% increase in health insurance premiums due to this change in the underlying health risk of the insured population. In sum, these changes could potentially increase the under-65 health insurance coverage rate to 12.9%, eroding much of the gains from the ACA with respect to health insurance coverage in California.

**Which Californians will Lack Health Insurance under the Affordable Care Act (January 2015)[53]**

In 2015, CalSIM was used to model the number of uninsured in California in 2019 and the demographic characteristics of the uninsured in 2019. CalSIM predicted that in 2019 2.7-3.4 Californians would remain uninsured and that these figures would have been approximately double without the ACA. Analysis of the demographic characteristics of the remaining uninsured suggested that 34-42% of this group were Medicaid eligible or had access to subsidies through Covered California. Up to a half of the remaining uninsured were also predicted to be undocumented immigrants, a group that is not eligible for the federal coverage options under the ACA. Finally, approximately 75% of the remaining uninsured were projected to be Latino, more than half of the remaining uninsured were projected to be limited in English proficiency and more than 2/3s living in low-income households.

[53] Miranda Dietz, Dave Graham-Squire, Tara Becker, Xiao Chen, Laurel Lucia and Ken Jacobs. (January 2015). *Which Californians will Lack Health Insurance under the Affordable Care Act.* UC Berkeley Center for Labor Research and Education; UCLA Center for Health Policy Research.

# Appendix I: Individual Targets for Simulated Annealing Procedure from CHIS 2011-12, CPS weights

| Variable | Categories |
|---|---|
| Age | 0-18, 19-29, 30-44, 45-64, 65+ |
| FPL | Age 0-64: 0-138, 139-400, 401+<br>Age 65+: Any |
| Limited English Proficiency | Age 18-64: Limited English Proficiency, No Limited English Proficiency<br>Age < 18: NA<br>Age 65+: Any |
| Race/Ethnicity | Age 0-64: White-Non-Latino, Latino, African American-Non-Latino, (Asian/Pacific-Islander)-Non-Latino, Multi-racial-All Other Non-Latino<br>Age 65+ - Any |
| Immigration Status | Documented, Undocumented |
| Immigration Status x Age x FPL | Age 0-18: <266% FPL, 267+% FPL<br>Age 19+: <138% FPL, 139-400% FPL, 400+% FPL |
| Approximate Program Eligibility | Age 65+, Undocumented, Medi-Cal Eligible, Subsidy Eligible <200% FPL, Subsidy Eligible >200%, Other income <400% FPL, Other income >400% FPL |
| Health insurance | Age 0-64: Uninsured, Individual Market, Medicaid, Employee Sponsored Health Insurance, Medicare and Other Public<br>Age 65+: Any |
| Health status | Age 0-64: Excellent, Very Good, Good, Fair/Poor<br>Age 65+: Any |
| Chronic Conditions | Age 18+: None, 1+<br>Age < 18: NA<br>Age 65+: Any |
| Employment Status | Age 18-64: Unemployed, Full Time, Part Time |

| | |
|---|---|
| | Age < 18: NA<br>Age 65+: Working, Not Working |
| Worker Class | Age 18+: Private, Government, Self-Employed, Not Working<br>Age <18: NA |

# Appendix II: Version History and Related Publications

The California Simulation of Insurance Markets (CalSIM) model was developed by the UC Berkeley Center for Labor Research and Education and the UCLA Center for Health Policy Research in 2011 to predict impacts of legislative proposals at the federal and state level. Funding to develop the model was originally provided by the California Endowment as part of UC Berkeley's California Health Policy Research Program grant, and was continued with foundational support from Covered California and the California Endowment. Several other funders provided vital supplemental support to CalSIM's modeling and analytic efforts: the California Health Care Foundation, The California Wellness Foundation, Blue Shield of California Foundation, the California Pan-Ethnic Health Network, and the San Diego Council of Community Clinics (now called Health Center Partners).

For details on the methodology used for Version 1 of CalSIM and the various publications associated with this earlier version of the model, see "CalSIM Version 1.8 Methodology and Assumptions,"
https://healthpolicy.ucla.edu/publications/Documents/PDF/calsim1.8methods.pdf

## Version 2.0

CalSIM 2.0 improves upon CalSIM 1.9 in numerous, substantive ways. First, and most importantly, CalSIM 1.9 was an elasticity-based model, while CalSIM 2.0 is a utility-based model. Utility based models allow for analyses of policy effects at the micro-individual level when compared to elasticity-based models. Second, decision-making in CalSIM 2.0 occurs at the level of family via health insurance eligibility units (HIEUS). HIEU decision-making is more analogous to real world decision-making and also allows for reporting of family-level statistics. Third, CalSIM 2.0 allows for non-offering firms to offer health insurance in response to a given policy change, whereas previously firms in CalSIM were only allowed to keep or drop coverage. Fourth, CalSIM 2.0 allows for dynamic premiums within the group and non-group markets, which allows

for calculations with respect to changing risk pools. Fifth, CalSIM 2.0 incorporates variation in minimum-wage policies at the regional level within California and allows for low-income undocumented children to be covered by Medi-Cal.

> Dylan Roby, Miranda Dietz, Xiao Chen, Gregory Watson, David Graham-Squire, Laurel Lucia, Petra Rasmussen, Jack Needleman, Gerald Kominski, Ken Jacobs. (June, 2018). Removing the Individual Mandate Penalty: What Will Happen to Insurance Enrollment and Premium Growth in California. Academy Health Oral Presentation.

This methodology document reflects the model as of April 2019, version 2.4. Much of the methodology has been consistent throughout the development of versions 2.0 through 2.4. Below we detail the improvements made between versions.

## Version 2.1 and 2.2

In version 2.1 we refined how we inflated the premium contribution cap for individual market subsidies. We also adjusted the psychologic effect of the mandate to inflate at 6% to keep pace with medical inflation and maintain more of its strength compared to individual market premiums over time. We also refined how we calculated subsidy amounts and added adjustments to match the unsubsidized individual market FPL distribution according to CHIS 2016. Version 2.2 featured a new input data set that focused on the distribution of firm offer and enabled analysis focused on hieu characteristics, including those caught in the "family glitch." We also added calibration targets for Bronze coverage and two different sets of parameters to model of the individual mandate penalty which allowed us to report a range for the effect of its removal.

> Miranda Dietz, Laurel Lucia, Dylan H. Roby, Ken Jacobs, Petra W. Rasmussen, Xiao Chen, Dave Graham-Squire, Greg Watson, Ian Eve Perry and Gerald F. Kominski. November 27, 2018. *California's Health Coverage Gains to Erode Without Further State Action*. UC Berkeley Center for Research on Labor and Employment, UCLA Center for Health Policy Research. Report.

## Versions 2.3 and 2.4

Version 2.3 was calibrated to 2017 administrative data and 2016-17 CHIS data. This version incorporated the full set of options with appropriate FPL calculations for tax-independent adult children, who are eligible for ESI through their parents but can also get subsidies through the exchange if their individual circumstances enable them to qualify. Version 2.4 incorporated refinements to our calculations of cost sharing and its effect on out-of-pocket costs. This version

also featured dynamic ESI premiums, and calibrated the age distribution of low-income undocumented population to better model expansion of Medicaid to low-income undocumented adults.

Miranda Dietz, Laurel Lucia, Srikanth Kadiyala, Petra W. Rasmussen, Ken Jacobs, Dylan H. Roby, Dave Graham-Squire, Jason Zhang, Greg Watson, Xiao Chen and Gerald F. Kominski. April 25, 2019. *3.6 Million Californians Would Benefit if California Takes Bold Action to Expand Coverage and Improve Affordability*. UC Berkeley Center for Research on Labor and Employment, UCLA Center for Health Policy Research. Report.